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5th International Conference on Energy and Environment Research, ICEER 2018

ICEER2018@Prague: researching towards a sustainable future

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Abstract

The 5th edition of the International Conference on Energy and Environment Research, ICEER 2018, took place in the end of July. The maturity of this conference series has now been reached, with a large number of participants from academia, as well as a few coming from the professional field. Linking together energy and environment research is not an easy task. However, it is now understood that these fields are interconnected and that the answer to the challenge of a sustainable future depend enormously on the willingness and capability of problem thinking in an integrated manner. This paper presents a brief summary of the participants in ICEER 2018 contribution towards sustainability, through energy and environment research.

Keywords: Education; energy; environment; research; sustainability

1. Introduction

The Energy and Environment Research series of conferences from the SCIence and Engineering Institute (SCIEI) reached its 5th edition with ICEER 2018. Continuing a previous successful experience, the ICEER2018@Prague conference was a joint organization of *Instituto Superior de Engenharia do Porto* (ISEP) of the Polytechnic of Porto

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(P.Porto) and of SCIEI, and took place at Prague, with the collaboration and promotion of the CIETI and LEPABE research groups, and of *Energies* as media partner.

This volume of *Energy Procedia* includes the full papers of the works presented at ICEER 2018 - the 5th International Conference on Energy and Environment Research, 23-27 July 2018, Prague, the Czech Republic. There is no distinction of those that were presented as full oral, poster + oral flash or poster presentation, as the type of presentation depends not only on the quality of the supporting material but also on the format preferred by their authors and, above all, on the best support for communicating the discoveries in a conference where there are Keynote and Invited speeches, along with parallel sessions for oral presentations, and meeting areas to discuss research results and prospects in smaller groups. Therefore, this volume, where the supporting full papers have been gathered together, serves as the Proceedings of ICEER 2018.

2. Conference topics

The ICEER conference series has focused in a broad scope of energy and environment research topics. In the 2018 edition of ICEER, particular attention was devoted to energy production, especially that derived from renewable sources, and to energy distribution and efficient use. However, the environmental aspects of energy were also the object of study of academics. In addition, there was also a strong focus and discussion on policy, eco-management systems and regulations associated with energy and environment topics, not only due to climate change mitigation, but especially due to sustainability objectives. The link between energy and water availability/scarcity and food resources has become of the outmost importance, and it can also be the engine of development and nations security.

ICEER2018@Prague was a privileged space to discuss current matters related to Energy and the Environment Research, having explored modern technologies and concepts in a collaborative way, bringing together researchers and professionals from different areas of activity and different cultures. The way to achieve tighter targets and sustainable development goals that have been adopted by several countries is nation dependent. The multidisciplinarity and the transgenerational character of such problems makes it harder to educate the professionals of tomorrow.

The conference was organized under five main topics:

- Advanced energy technologies;
- Education for sustainability;
- Energy and environment;
- Fuels and combustion;
- Renewable energy.

Specifically, ICEER2018 contribution covered 13 themes, each of them forming at least one conference session:

- Biofuels production and sustainability;
- Bioproducts from biomass;
- Climate impacts and mitigation;
- Combustion;
- Energy and environment management;
- Energy harvesting & storage;
- Energy systems modelling;
- Simulation, modelling and multi-criteria analysis
- Sustainability & health;
- Sustainable buildings and cities;
- Water pollution and treatment;
- Waste valorization;
- Wind and solar energy systems.

3. Organizing, scientific and technical committees

The ICEER 2018 Conference and Program chairs would like to express their deepest thanks to the Scientific and Technical Committee (STC) and to the Staff of SCIEI. In order to guarantee the quality of the presented work, the

ICEER2018 STC decided to count on the collaboration of a number of Invited Reviewers. The structure of organization was as follows:

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4. Conference statistics

The 5th edition of ICEER has received 199 submissions by 453 authors from 51 countries, from 5 continents in the world. After a thorough peer revision process by at least two reviewers (from the 80 STC members and 8 invited reviewers), 110 full papers and 40 abstracts have been accepted for oral/poster+oral flash and poster presentation, respectively.

The distribution of participants (132) by country is shown in Fig. 1.

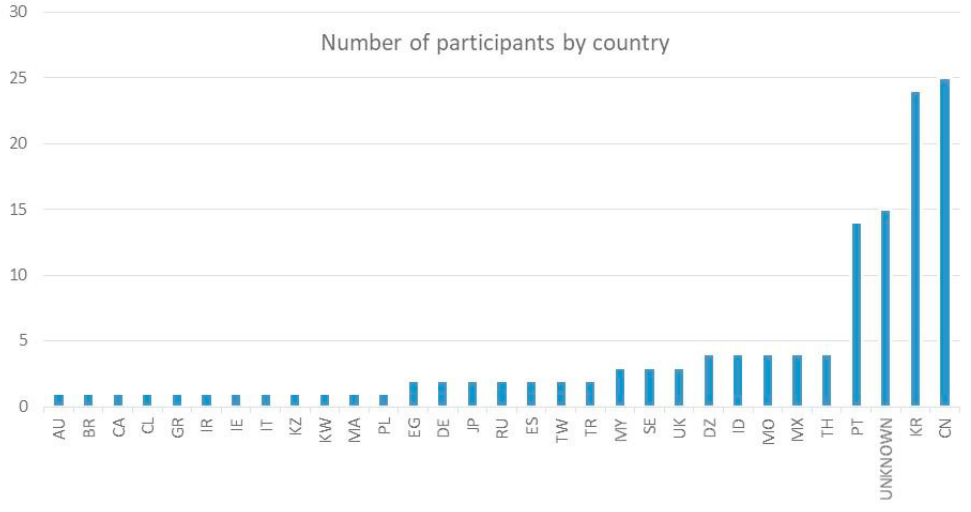

Fig. 1. Distribution of ICEER2017 participants by country.

As can be observed in Fig. 1, the highest number of participants (19%) came from China, followed by Korea (18%) and Portugal (11%). Thailand, Mexico, Macao, Indonesia and Algeria had 3% participants each. This distribution not only confirms the extent of internationalization that ICEER has reached (important delegations came from very different places far in the world), but also demonstrates the growing involvement and commitment of the academy from Asian countries towards sustainable development. In addition, there were no cultural barriers which could be perceived by the free and active participation of the delegates from 28 countries. However, the difficulties in VISA acquisition prevented a number of authors to participate in the conference. ICEER 2018 received participants from more than 28 countries, from five continents, which justifies the increasing high internationalization of this conference series.

In what concerns the topics most hotly presented and debated by researchers and practitioners who attended ICEER 2018 a brief statistic of the number of papers presented within each theme is shown in Fig. 2. Of the 13 themes, the biggest number of contributions was related to Energy and environment management and sustainable buildings and cities. However, there was not a very significant difference among the number of papers per topic.

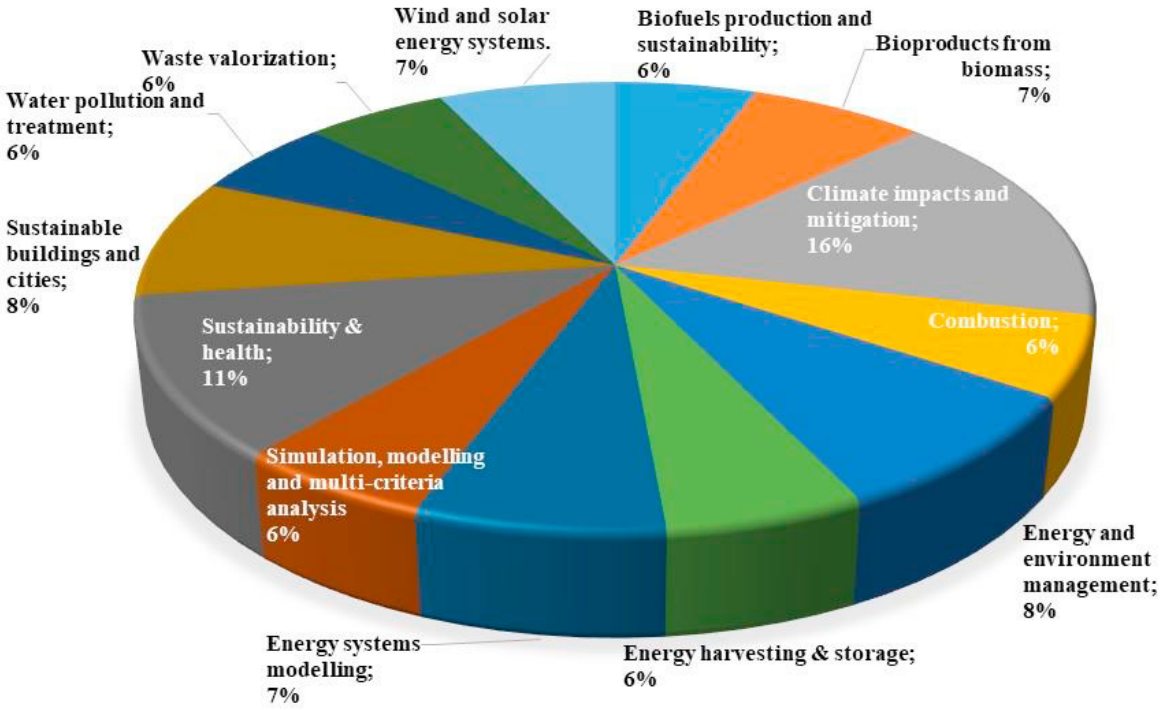

Fig. 2. Distribution of conference papers.

5. Keynote and Invited lectures of ICEER2018

Following the format adopted in the two past editions, in ICEER 2018 there were six Keynote lectures that took place in the morning of the second and third days of the conference.

Long career international researchers have been invited and challenged to share their views and expertise in preferred topics that were within the scope of the conference, aiming to kick-off debate and brainstorming among participants. This debate extended through the coffee breaks and lunch time. This was a unique opportunity for younger researchers to meet established and renowned experts.

It was extremely rewarding to acknowledge there were no generational or cultural barriers preventing participants from a broad range of scientific areas to interact.

Alírio Rodrigues (1943) is *Emeritus Professor* at the U. Porto since 2013. During his 50 years career in Chemical Engineering, he received several awards: Medal of Scientific Merit of MCTES in 2016; AIChE The Separation Division, Honorary session, Atlanta, 2014; PSE Model-based Innovation Prize, (with C. Pereira and V. Silva), 2012; IChemE Award the ABB Global Consulting Award for Sustainable Technology (with V. Silva), 2008. He supervised more than 60 PhD students, and 60 Post-doc researchers, published +600 articles in SCI, several patents and books, organized and participated in hundreds of scientific meetings. In his Keynote Speech entitled *Valorization of lignin: a contribution to the circular economy in the pulp industry*, Prof. Alírio Rodrigues presented the integrated process for lignin valorization developed in his lab, where the strategy is to combine reaction engineering and efficient separation processes for conversion of lignin from pulping liquors. The goal of this research is to produce several value-added products: vanillin, syringaldehyde and oligomers that can be used as polyols for special polymers, allowing the complete valorization of lignin. Throughout his speech, Alirio Rodrigues demonstrated how his career was built and how research strategies can be developed towards oriented problem solving in a collaborative way.

Ambra Giovannelli (197x) is Researcher of Fluid Machinery, *Professor Aggregato* of Turbomachinery (MS degree) and Applied Thermodynamics and Fluid-dynamics (BS degree) in the Department of Engineering at ROMA TRE University, Rome, Italy, author of many papers and technical reports in the field of Fluid Machinery and Energy Conversion Systems. Her research work is focused on turbomachinery modelling (Supercritical CO2 Turbomachines, Gas Turbines (GTs) fuelled with syngas, Solar GTs, Hybrid GTs), power production from renewable energy (high-temperature solar concentrators, reactors and TGs), storage systems (PCM storage systems and CAES) and energy-saving in refrigeration and cryogenic plants (e.g. regeneration in Vapour Compression Refrigeration Plants, regenerative cooling systems for automotive applications). Her Keynote Speech entitled *Development of Turbomachines for Renewable Energy Systems and Energy-Saving Applications,* showed that turbomachines play a significant role in some key sectors such as power production, aircraft and marine propulsion, HVAC, chemical processing. Several case studies based on the Prof. Ambra Giovannelli' experience were presented, from the preliminary design of new turbomachines for supercritical CO_2 plants to the development and prototyping of unconventional systems for energy-saving in industrial vapor-compression cooling plants.

José A. Tenreiro Machado (1957) is *Principal Coordinator Professor* at the Dept. of Electrical Engineering, School of Engineering, Polytechnic of Porto, Portugal. During 1980-1998 he worked at the Dept. of Electrical and Computer Engineering of the University of Porto. He published 98 chapters of international books, 345 papers in international journals, 364 papers in international conferences and was the Editor of 14 books, Guest-Editor of 39 special issues in journals, Editor-in-Chief of several peer review journals. His Keynote Speech entitled *The Garden of Earthly Delights* represented a delightful historical view of the growing importance of Fractional Calculus (FC) not only for mathematicians (from 1695), but for numerous other not so well-known applications and developers. By the beginning of the twentieth century FC was applied by Olivier Heaviside in the electrical engineering, but, the visionary and important contributions were forgotten. Later, FC emerged associated with phenomena such as fractal and chaos and, consequently, in nonlinear dynamics. Recently, FC has become 'new' tool for the analysis of dynamical systems. FC is now recognized to be an important tool to model and control systems with long range memory effects. Finally, the lecture introduced the FC fundamental concepts and presented several applications in distinct areas of science and engineering.

Jürgen Mahlknecht (1970) is research chair of Water Science and Technology at Tecnológico de Monterrey, founding director of the Water Center for Latin America and the Caribbean and serves as *Associated Research Professor* at Tecnológico de Monterrey. Previously he worked as researcher at University of Guanajuato (Mexico), University of Applied Life Sciences Vienna (Austria), National Autonomous University of Mexico and University of Guanajuato (Mexico). Graduated in Water and Wastewater Management and Engineering and PhD in Hydrogeology from University of Applied Life Sciences Vienna, Austria. He has more than 20 years of research on water resources management, hydrogeochemistry and isotope hydrology, groundwater contamination and remediation. He received several distinctions (Sistema Nacional de Investigadores), awards (Dr. Karl-Heinz Schleinzer, Austria) and prizes (Eternit-Tiefbau Preis, Austria). In his Keynote Speech entitled *Water-Energy-Food Nexus: A Review on the Current Situation and Future Challenges in Latin America and the Caribbean*, he presented the Water-Energy-Food Nexus, a

conceptual framework for analyzing and managing natural resources for life and sustainable development, for which it is well known the intrinsic relation between these three sectors. His speech presented an actual overview of the current state of the water-energy-food nexus in Latin American and The Caribbean countries. The analysis presented the water, energy and food security index for each country, that comprises three key indicators per sector, considering availability, access, and stability of sector's resources. The obtained results show that all three sectors need more attention for future development, especially in the Caribbean countries.

Carlos Felgueiras (1963) started is professional activity in 1987 as electronic designer for automation systems. Later he was invited to supervise a test laboratory aimed at verifying the accomplishment of European Standards in thermoelectric household appliances. He started the teaching activity in 1994 as Assistant Professor and later on as Adjunct Professor and researcher with the Department of Electrical Engineering, School of Engineering, Polytechnic of Porto (P.Porto), Portugal. In his Keynote Speech entitled *To be or not to be… sustainable in education*, Prof. Carlos Felgueiras defended that Sustainable Development is an unavoidable topic that has become a civilizational mater of today, i.e., which humanity depends on. Sustainable Development has followed different paths, thus several actions have been implemented to increase the efficiency of modern systems. However, this growth in efficiency has led to a rise in the complexity of solutions that are increasingly multidisciplinary. Teaching engineering, and particularly sustainable issues, is currently facing difficulties since the single-disciplinary basic training is insufficient for the current problems. In addition, the new generation of Digital Natives feel more comfortable at the Software level than in Hardware. He defended that one way to overcome these limitations is to place students at the center of the Teaching / Learning process by developing solutions to increase Sustainable Development, while other consists on the use of Remote Laboratories, which allow performing real experiences guided by Computers or even Smart Phones. In his presentation, it was addressed how to reach Sustainable Development, by involving this new generation of graduates in multidisciplinary environments.

Michael Hartnett (1963) is a Professor in Civil Engineering, NUI Galway, a Visiting Professor at Hohai University, Nanjing, China and at the University of Edinburgh. He has co-authored 60 journal papers and is on the editorial boards of 5 international journals. He is Deputy Director of the Science Foundation Ireland funded Research Centre, for Marine and Renewable Energy, MaREI and leads the Hydraulic Modelling team at NUI Galway, much of his current research is focussed on marine renewable energy and member of the Irish Committee of the International Hydrology Programme. His group set up the first Irish operational system for marine forecasting. His models have been used to provide national surge forecasts to the Irish Office of Public Works. His group has developed an innovative flood modelling system which is based on a nested approach for ultra-high resolution hydraulic modelling of flood events in urban areas. Prof. Michael Hartnett has worked as Expert Advisor to the Irish Government on radionuclide transport in the Irish Sea. He was awarded the Excellence in Marine Research Award' at the Marine Industry Awards in 2016 and was awarded the Telford Premium Award from the Institution of Civil Engineers, London. In his Keynote Speech entitled *Developments in Marine Renewable Energy*, Prof. Hartnett demonstrated how important it is to gather accurate information of surface currents, not only for economic but also for environmental operations relating to marine renewable energy extraction. His vast experience in this field allowed him to present some case studies.

The sessions after lunch started with 3 Invited Lectures (2 in the second and one in the third day), aiming to prepare the audience to the more specific topics that would be presented and debated in the parallel sessions.

Nídia S. Caetano (1964) graduated and received her Ph.D. degrees in Chemical Engineering from the Faculty of Engineering of the University of Porto (FEUP), Portugal, in 1987 and 1996, respectively. She started her academic career in 1992, as Assistant Professor and is today Coordinator Professor with the Chemical Engineering Department, School of Engineering (ISEP), Polytechnic of Porto (P.Porto), Portugal. She was the Subdirector of the Chemical Engineering Department of ISEP for 4 years, having been laboratory Director for ten years (2001-2011). From March 2013 to June 2018 she was the Director of the Master Course in Sustainable Energies of ISEP, in the Mechanical Engineering Department of ISEP. Prof. Caetano is member of the Portuguese Engineers Association (OE), and also of the Portuguese Association of Environmental and Sanitary Engineering (APESB) where she is involved in the solid waste section (GRAPESB). She started her R&D career in the LSRE of FEUP in 1987, where she did her PhD research in MTBE kinetic study in a batch reactor and simulation / operation of a fixed bed reactor and is nowadays senior

researcher with LEPABE/FEUP and collaborator researcher with CIETI/ISEP. In her Invited Lecture entitled *Educating Engineering Professionals on Sustainability: Living Labs as a Tool for an Integrated Approach*, Prof. Caetano used her over 25 years of experience in the academia as professor of different courses and levels of graduation to discuss the need for hands on collaborative living laboratories, as a tool to develop the multidisciplinary and teamwork skills that are nowadays fundamental for young professionals.

Rui Calejo Rodrigues (1960) graduated with *Licenciatura* (1983), MSc. (1989) and PhD. (2003), in Civil Engineering at the Faculty of Engineering of the University of Porto (FEUP). Since 1984 he has been teaching at the Department of Civil Engineering of FEUP, where he is presently Assistant Professor, Integrated Researcher at CONSTRUCT and Head of NI&DEA which stands for Nucleus of Research and Development in Acoustic Engineering. Under his supervision, more than 150 theses were successfully presented to several institutions. He published 4 book chapters of international, 12 papers in international journals, 34 papers in international conferences and was the Editor of 4 books and author of other 6 books. His Invited Lecture entitled *Quiet Areas and Urban Sustainability* discussed the lack of consideration of the noise factor within sustainability strategies urban areas analysis and planning. Contrary to natural resources, energy, economy, air quality and other environmental factors usually associated to sustainability studies, noise is usually forgotten. In addition, more than a comfort problem, urban noise is nowadays a health issue related with major diseases such as high arterial pressure, headaches and stress. The "quiet area" concept deals with the importance of keeping urban soundscapes as a "resource" for newer generations. Therefore, this lecture was focused in the relationship between urban noise and sustainability in "quiet areas" where different aspects such as natural resources maintenance, air quality and natural noise implications on people's health are considered. Data from a case study at Oporto were presented as an illustration of the concept.

Biao Wang is a Lecturer at the North China Institute of Technology - College of Architecture and Art China. His Invited Lecture entitled *Wind Potential Evaluation with Urban Morphology-A Case Study in Beijing* avowed that wind energy is beneficial for the sustainable development of cities. With increasing new wind turbine technologies and CFD techniques, urban wind becomes to attract public attention while large-scale wind capacity installation is stabilizing. His lecture demonstrated how to estimate wind energy within the angle of urban morphology. Seven different urban tissues were compared and analyzed with several relevant urban morphology parameters. Numerical simulations in CFD were undertaken to visualize the outcome of wind energy of each urban tissue. The results showed that the forms with lower floor area ratio usually have the higher wind potential density, and the forms with higher porosity usually have the higher wind potential density on unit of roof surface.

All the sessions were chaired by one conference member from academia, who was ready to mediate the discussion and to give participants of ICEER 2018 the opportunity to listen to and interact with experts in different fields of energy and environment**.**

The posters were shown during the coffee breaks, lunch period and social dinner, when everyone had the opportunity to analyze and discuss with their authors the achievements represented in it.

6. Other activities within ICEER2018

Conferences are not only places to discuss research and professional topics, but also large rooms to socialize. Therefore, similarly to the past edition, the Conference Dinner and the farewell session allowed to distinguish some of the participants/authors with the ~~*Academy*~~ *aComedy Awards*, a kind of funny prizes to award various paper categories such as the wildest paper title, longest paper title, biggest number of authors, shortest number of authors, etc.

Finally, the ICEER2018 organization promoted the attribution of the Best Paper award, for each Session of oral presentations. Additionally, a Best Oral Flash award was attributed to the author of the Best Poster who also presented it as an Oral flash presentation.

A closing ceremony and a farewell event were organized, in which authors were distinguished with formal and non-formal awards.

Acknowledgements

Dear participant in ICEER2018@Prague,

Our first acknowledgement goes to those that participated in the Conference and shared with all of us the results of their work and ideas – thank you for having been there with us!
We believe that the conference was a big success due to your efforts.
We sincerely hope you have enjoyed your stay and the conference.

We would also like to publicly thank the SCIEI organization, for their efforts and commitment to improve ICEER quality. Particularly the kind staff – Cindy and Tina.
Our deepest thanks to our research group coordinators, who believed in us and allowed us to spend part of our time preparing the conference.

The process of editing the Conference Proceedings in Energy Procedia – a Scopus Indexed journal from Elsevier – is now finished.
Nevertheless, there is still the opportunity to ask for your collaboration to finish the publication of the associated Special Issues of *Energies*. This was our final contribution to continue increasing the scientific importance and impact of ICEER series.

The next ICEER conference (ICEER 2019) will take place in the 4th week of July 2019 @ Universidade de Aveiro – Save the Date, please!
We are eager to show you what will be happening in our future event – website will soon be available with details and news.

Thank you all for having been there with us.
Next event will be even better!!!
We hope to meet you soon (again) in… ***ICEER2019@UAveiro***

The ICEER2018 Conference & Program Chairs

Carlos & Nídia